# PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

## PCT

### NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark Office, PCT
2011 South Clark Place Room CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

| | |
|---|---|
| **Date of mailing** (day/month/year)<br>22 December 2000 (22.12.00) | |
| **International application No.**<br>PCT/GB00/01629 | **Applicant's or agent's file reference**<br>WPP81316 |
| **International filing date** (day/month/year)<br>27 April 2000 (27.04.00) | **Priority date** (day/month/year)<br>27 April 1999 (27.04.99) |
| **Applicant**<br>MCLOUGHLIN, Stephen, John | |

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

24 November 2000 (24.11.00)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

| | |
|---|---|
| **The International Bureau of WIPO**<br>**34, chemin des Colombettes**<br>**1211 Geneva 20, Switzerland** | Authorized officer<br>Pascal Piriou |
| Facsimile No.: (41-22) 740.14.35 | Telephone No.: (41-22) 338.83.38 |

PCT

# REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference *(if desired) (12 characters maximum)* WPP81316

**Box No. I TITLE OF INVENTION**

Apparatus and Method for Transmitting Information to and Communicating with a Downhole Device

**Box No. II APPLICANT**

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

McLoughlin, Stephen John
36 Wychwood Close,
Bognor Regis, West Sussex, PO21 4DW,
United Kingdom

[X] This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State *(that is, country)* of nationality: GB

State *(that is, country)* of residence:

This person is applicant for the purposes of: [X] all designated States [ ] all designated States except the United States of America [ ] the United States of America only [ ] the States indicated in the Supplemental Box

**Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)**

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:

[ ] applicant only

[ ] applicant and inventor

[ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is,country)* of nationality:

State *(that is, country)* of residence:

This person is applicant for the purposes of: [ ] all designated States [ ] all designated States except the United States of America [ ] the United States of America only [ ] the States indicated in the Supplemental Box

[ ] Further applicants and/or (further) inventors are indicated on a continuation sheet.

**Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE**

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: [X] agent [ ] common representative

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

Granleese, Rhian Jane
Marks & Clerk
57-60 Lincoln's Inn Fields
London WC2A 3LS
United Kingdom

Telephone No.
020-7400-3000

Facsimile No.
020-7400-4910

Teleprinter No.
25311 EMANDC G

[ ] **Adress for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) *(mark the applicable check-boxes; at least one must be marked)*:

Regional Patent

☒ AP ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SL Sierra Leone, SZ Swaziland, TZ United Republic of Tanzania, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT

☒ EA Eurasian Patent: AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT

☒ EP European Patent: AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT

☒ OA OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT *(if other kind of protection or treatment desired, specify on dotted line)* .....

National Patent *(if other kind of protection or treatment desired, specify on dotted line)*:

☒ AE United Arab Emirates
☒ AL Albania
☒ AM Armenia
☒ AT Austria
☒ AU Australia
☒ AZ Azerbaijan
☒ BA Bosnia and Herzegovina
☒ BB Barbados
☒ BG Bulgaria
☒ BR Brazil
☒ BY Belarus
☒ CA Canada
☒ CH and LI Switzerland and Liechtenstein
☒ CN China
☒ CR Costa Rica
☒ CU Cuba
☒ CZ Czech Republic
☒ DE Germany
☒ DK Denmark
☒ DM Dominica
☒ EE Estonia
☒ ES Spain
☒ FI Finland
☒ GB United Kingdom
☒ GD Grenada
☒ GE Georgia
☒ GH Ghana
☒ GM Gambia
☒ HR Croatia
☒ HU Hungary
☒ ID Indonesia
☒ IL Israel
☒ IN India
☒ IS Iceland
☒ JP Japan
☒ KE Kenya
☒ KG Kyrgyzstan
☒ KP Democratic People's Republic of Korea
☒ KR Republic of Korea
☒ KZ Kazakhstan
☒ LC Saint Lucia
☒ LK Sri Lanka
☒ LR Liberia
☒ LS Lesotho
☒ LT Lithuania
☒ LU Luxembourg
☒ LV Latvia
☒ MA Morocco
☒ MD Republic of Moldova
☒ MG Madagascar
☒ MK The former Yugoslav Republic of Macedonia
☒ MN Mongolia
☒ MW Malawi
☒ MX Mexico
☒ NO Norway
☒ NZ New Zealand
☒ PL Poland
☒ PT Portugal
☒ RO Romania
☒ RU Russian Federation
☒ SD Sudan
☒ SE Sweden
☒ SG Singapore
☒ SI Slovenia
☒ SK Slovakia
☒ SL Sierra Leone
☒ TJ Tajikistan
☒ TM Turkmenistan
☒ TR Turkey
☒ TT Trinidad and Tobago
☒ TZ United Republic of Tanzania
☒ UA Ukraine
☒ UG Uganda
☒ US United States of America
☒ UZ Uzbekistan
☒ VN Viet Nam
☒ YU Yugoslavia
☒ ZA South Africa
☒ ZW Zimbabwe

Check-boxes reserved for designating States which have become party to the PCT after issuance of this sheet:

☐ Plus any other PCT contracting state not listed above. cf. sh. page 3

**Precautionary Designation Statement:** In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. *(Confirmation (including fees) must reach the receiving Office within the 15-month time limit.)*



*See Notes to the request form*

**Supplemental Box** *If the Supplemental Box is not used, this sheet should not be included in the request.*

*1. If, in any of the Boxes, the space is insufficient to furnish all the information: in such case, write "Continuation of Box No. ..." [indicate the number of the Box] and furnish the information in the same manner as required according to the captions of the Box in which the space was insufficient, in particular:*

*(i) if more than two persons are involved as applicants and/or inventors and no "continuation sheet" is available: in such case, write "Continuation of Box No. III" and indicate for each additional person the same type of information as required in Box No. III. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below;*

*(ii) if, in Box No. II or in any of the sub-boxes of Box No. III, the indication "the States indicated in the Supplemental Box" is checked: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the applicant(s) involved and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is applicant;*

*(iii) if, in Box No. II or in any of the sub-boxes of Box No. III, the inventor or the inventor/applicant is not inventor for the purposes of all designated States or for the purposes of the United States of America: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the inventor(s) and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is inventor;*

*(iv) if, in addition to the agent(s) indicated in Box No. IV, there are further agents: in such case, write "Continuation of Box No. IV" and indicate for each further agent the same type of information as required in Box No. IV;*

*(v) if, in Box No. V, the name of any State (or OAPI) is accompanied by the indication "patent of addition," or "certificate of addition," or if, in Box No. V, the name of the United States of America is accompanied by an indication "continuation" or "continuation-in-part": in such case, write "Continuation of Box No. V" and the name of each State involved (or OAPI), and after the name of each such State (or OAPI), the number of the parent title or parent application and the date of grant of the parent title or filing of the parent application;*

*(vi) if, in Box No. VI, there are more than three earlier applications whose priority is claimed: in such case, write "Continuation of Box No. VI" and indicate for each additional earlier application the same type of information as required in Box No. VI;*

*(vii) if, in Box No. VI, the earlier application is an ARIPO application: in such case, write "Continuation of Box No. VI", specify the number of the item corresponding to that earlier application and indicate at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed.*

*2. If, with regard to the precautionary designation statement contained in Box No. V, the applicant wishes to exclude any State(s) from the scope of that statement: in such case, write "Designation(s) excluded from precautionary designation statement" and indicate the name or two-letter code of each State so excluded.*

*3. If the applicant claims, in respect of any designated Office, the benefits of provisions of the national law concerning non-prejudicial disclosures or exceptions to lack of novelty: in such case, write "Statement concerning non-prejudicial disclosures or exceptions to lack of novelty" and furnish that statement below.*

Continuation of Box V - Designation of States

DZ - Algeria
AG - Antigua & Barbuda

**Box No. VI PRIORITY CLAIM** ☐ Further priority claims are indicated in the Supplemental Box.

| Filing date of earlier application (day/month/year) | Number of earlier application | Where earlier application is: national application: country | regional application:* regional Office | international application: receiving Office |
|---|---|---|---|---|
| item (1) 27 Apr 1999 (27/4/99) | 60/131208 | US | | |
| item (2) 9 Nov 1999 (9/11/99) | 9926545.6 | GB | | |
| item (3) | | | | |

☒ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) *(only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office)* identified above as item(s): (2)

* *Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.*

**Box No. VII INTERNATIONAL SEARCHING AUTHORITY**

**Choice of International Searching Authority (ISA)** *(If two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):*
ISA /

**Request to use results of earlier search; reference to that search** *(If an earlier search has been carried out by or requested from the International Searching Authority):*
Date *(day/month/year)* Number Country *(or regional Office)*

**Box No. VIII CHECK LIST; LANGUAGE OF FILING**

This international application contains the following **number of sheets:**

| | |
|---|---|
| request | : 4 |
| description (excluding sequence listing part) | : 15 |
| claims | : 4 |
| abstract | : 1 |
| drawings | : 6 |
| sequence listing part of description | : |
| **Total number of sheets** | : 30 |

This international application is **accompanied by** the item(s) marked below:

1. ☒ fee calculation sheet
2. ☐ separate signed power of attorney
3. ☐ copy of general power of attorney; reference number, if any:
4. ☐ statement explaining lack of signature
5. ☐ priority document(s) identified in Box No. VI as item(s):
6. ☐ translation of international application into (language):
7. ☐ separate indications concerning deposited microorganism or other biological material
8. ☐ nucleotide and/or amino acid sequence listing in computer readable form
9. ☒ other *(specify)*: Form 23/77

**Figure of the drawings which should accompany the abstract:** 4A

**Language of filing of the international application:** English

**Box No. IX SIGNATURE OF APPLICANT OR AGENT**

*Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).*

RH Granleese

Granleese, Rhian Jane

**For receiving Office use only**

1. Date of actual receipt of the purported international application:
2. Drawings: ☐ received: ☐ not received:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:
4. Date of timely receipt of the required corrections under PCT Article 11(2):
5. International Searching Authority (if two or more are competent): ISA /
6. ☐ Transmittal of search copy delayed until search fee is paid.

**For International Bureau use only**

Date of receipt of the record copy by the International Bureau:

*The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:*

IPEA/ _____

# PCT

**CHAPTER II**

## DEMAND

under Article 31 of the Patent Cooperation Treaty:
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only

| Identification of IPEA | Date of receipt of DEMAND |
|---|---|
| | |

**Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION**

Applicant's or agent's file reference: WPP81316

| International application No. | International filing date *(day/month/year)* | (Earliest) Priority date *(day/month/year)* |
|---|---|---|
| PCT/GB00/01629 | 27 April 2000 | 27 April 1999 |

Title of invention: Apparatus and method for transmitting information to and communicating with a down-hole device

**Box No. II APPLICANT(S)**

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

MCLOUGHLIN, Stephen John
36 Wychwood Close
Bognor Regis
West Sussex
PO21 4DW

Telephone No.:

Facsimile No.:

Teleprinter No.:

| State *(that is, country)* of nationality: | State *(that is, country)* of residence: |
|---|---|
| GB | GB |

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

| State *(that is, country)* of nationality: | State *(that is, country)* of residence: |
|---|---|
| | |

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

| State *(that is, country)* of nationality: | State *(that is, country)* of residence: |
|---|---|
| | |

☐ Further applicants are indicated on a continuation sheet.

Sheet No. 2

International application No. PCT/GB00/01629

**Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE**

The following person is [X] agent [ ] common representative

and [X] has been appointed earlier and represents the applicant(s) also for international preliminary examination.

[ ] is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.

[ ] is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

GRANLEESE, Rhian Jane
57-60 Lincoln's Inn Fields
London
WC2A 3LS

Telephone No.: 0207 400 3000

Facsimile No.: 0207 404 4910

Teleprinter No.: 25311 EMANDC G

[ ] Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

**Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION**

**Statement concerning amendments:***

1. The applicant wishes the international preliminary examination to start on the basis of:

[X] the international application as originally filed

the description [ ] as originally filed
[ ] as amended under Article 34

the claims [ ] as originally filed
[ ] as amended under Article 19 (together with any accompanying statement)
[ ] as amended under Article 34

the drawings [ ] as originally filed
[ ] as amended under Article 34

2. [ ] The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.

3. [ ] The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). *(This check-box may be marked only where the time limit under Article 19 has not yet expired.)*

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

**Language for the purposes of international preliminary examination:** English

[X] which is the language in which the international application was filed.

[ ] which is the language of a translation furnished for the purposes of international search.

[ ] which is the language of publication of the international application.

[ ] which is the language of the translation (to be) furnished for the purposes of international preliminary examination.

**Box No. V ELECTION OF STATES**

The applicant hereby elects all eligible States *(that is, all States which have been designated and which are bound by Chapter II of the PCT)*

excluding the following States which the applicant wishes not to elect:

Sheet No. 3

International application No. PCT/GB00/01629

**Box No. VI CHECK LIST**

| The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination: | | | For International Preliminary Examining Authority use only: received | not received |
|---|---|---|---|---|
| 1. translation of international application | : | sheets | ☐ | ☐ |
| 2. amendments under Article 34 | : | sheets | ☐ | ☐ |
| 3. copy (or, where required, translation) of amendments under Article 19 | : | sheets | ☐ | ☐ |
| 4. copy (or, where required, translation) of statement under Article 19 | : | sheets | ☐ | ☐ |
| 5. letter | : | sheets | ☐ | ☐ |
| 6. other *(specify)* | : | sheets | ☐ | ☐ |

The demand is also accompanied by the item(s) marked below:

1. ☒ fee calculation sheet
2. ☐ separate signed power of attorney
3. ☐ copy of general power of attorney; reference number, if any:
4. ☐ statement explaining lack of signature
5. ☐ nucleotide and or amino acid sequence listing in computer readable form
6. ☐ other *(specify)*:

**Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE**

*Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).*

RK Granleese

Granleese, Rhian Jane

**For International Preliminary Examining Authority use only**

1. Date of actual receipt of DEMAND:
2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):
3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply. ☐ The applicant has been informed accordingly.
4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.
5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

**For International Bureau use only**

Demand received from IPEA on:

From the:
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

GRANLEESE, Rhian Jane
MARKS & CLERK
57-60 Lincoln's Inn Fields
London WC2A 3LS
GRANDE BRETAGNE



# PCT

## WRITTEN OPINION

(PCT Rule 66)

| | |
|---|---|
| Date of mailing *(day/month/year)* | 20.03.2001 |
| Applicant's or agent's file reference: WPP81316 | **REPLY DUE** **within 3 month(s)** from the above date of mailing |

| International application No. | International filing date *(day/month/year)* | Priority date *(day/month/year)* |
|---|---|---|
| PCT/GB00/01629 | 27/04/2000 | 27/04/1999 |

International Patent Classification (IPC) or both national classification and IPC

E21B47/12

Applicant

MCLOUGHLIN, Stephen John

1. This written opinion is the **first** drawn up by this International Preliminary Examining Authority.

2. This opinion contains indications relating to the following items:

| | | |
|---|---|---|
| I | ☒ | Basis of the opinion |
| II | ☐ | Priority |
| III | ☒ | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| IV | ☐ | Lack of unity of invention |
| V | ☒ | Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| VI | ☐ | Certain document cited |
| VII | ☒ | Certain defects in the international application |
| VIII | ☒ | Certain observations on the international application |

3. The applicant is hereby **invited to reply** to this opinion.

**When?** See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

**How?** By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

**Also:** For an additional opportunity to submit amendments, see Rule 66.4.
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4 bis.
For an informal communication with the examiner, see Rule 66.6.

**If no reply is filed,** the international preliminary examination report will be established on the basis of this opinion.

4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 27/08/2001.

Name and mailing address of the international preliminary examining authority:
European Patent Office
D-80298 Munich
Tel. +49 89 2399 - 0 Tx: 523656 epmu d
Fax: +49 89 2399 - 4465

Authorized officer / Examiner
Str mmen, H

Formalities officer (incl. extension of time limits)
Goenechea Olmos, A
Telephone No. +49 89 2399 2664

# WRITTEN OPINION

International application No. PCT/GB00/01629

## I. Basis of the opinion

1. This opinion has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed".*):

**Description, pages:**

1-15 as originally filed

**Claims, No.:**

1-22 as originally filed

**Drawings, sheets:**

1/4-4/4 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been and will not be examined in respect of:

☐ the entire international application,

☒ claims Nos. 21, 22,

because:

☒ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):
**see separate sheet**

☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☐ no international search report has been established for the said claims Nos. .

2. A written opinion cannot be drawn due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

☐ the written form has not been furnished or does not comply with the standard.

☐ the computer readable form has not been furnished or does not comply with the standard.

**V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrialapplicability; citations and explanations supporting such statement**

1. Statement

| | | |
|---|---|---|
| Novelty (N) | Claims | 1-7, 10, 16-20 No. 8, 9, 11-15 Yes. |
| Inventive step (IS) | Claims | 1-7, 10, 11, 16-20 No. 8, 9, 12-15 Yes |

Industrial applicability (IA) Claims 1-20 Yes

2. Citations and explanations
**see separate sheet**

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:
**see separate sheet**

**VIII. Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
**see separate sheet**

**WRITTEN OPINION**
**SEPARATE SHEET**

International application No. PCT/GB00/01629

Reference is made to the following document:

D1: US-A-4 763 258

**Re Item III**

**Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

III-1 Claims 21 and 22 do not specify explicitly and univocally any technical feature, and therefore they cannot be further examined. Furthermore, said claims contain references to the drawings. According to Rule 6.2(a) PCT, claims should not contain such references except where absolutely necessary, which is not the case here.

**Re Item V**

**Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

V-1 D1, which is considered the closest prior art, discloses the subject-matter of claim 1 as follows:

An apparatus for the use of drilling or producing from a well bore, the apparatus comprising a downhole member capable of being attached to a tubular (fig. 1), means for rotating the tubular (col. 4, l. 20-22), control means for controlling the rotation of said tubular in order to transmit information along said tubular (col. 4, l. 1-12) and means for monitoring the rotation of said tubular and for decoding said information transmitted along said tubular such that a magnitude of a parameter can be determined from the rotation of said tubular (col. 3, l. 47-57).

The subject-matter of claim 1 is therefore not new contrary to the provisions of Article 33(2) PCT.

V-2 Furthermore, D1 discloses the subject-matter of the following claims:

| | |
|---|---|
| Claim 2: | See col. 2, l. 8-12 |
| Claim 3, 4: | See col. 5, l. 31-33 |
| Claim 5: | See col. 5, l. 28-31 |
| Claim 6: | See col. 2, l. 13-17 |
| Claim 7: | See col. 5, l. 23-25 |
| Claim 10: | See col. 6, l. 59-63 |

The subject-matter of said claims is therefore not new (Article 33(2) PCT).

V-3 Claims 8 and 9 relate to the problem of establishing a non-contact rotational reference as described in D1, col. 3, l. 52-57, where the magnetic field of the earth is used. To substitute the magnetic field of the earth with the self-emitting devices of claim 8 and 9 is involving not only selecting the sources but also substantial design changes in that the sources can not rotate with the drill string. None of this is made obvious by the cited prior art such that claims 8 and 9 involve an inventive step (Article 33(3) PCT).

V-4 Once it is known to transmit information from a topside location to a downhole tool, it can not be considered inventive to apply these transmission means to the apparatus of claim 11. Said claim can therefore not involve an inventive step (Article 33(3) PCT).

V-5 Claim 12 is not clear, see section VIII-1 of this written opinion. As far as the claim can be understood it seems however to meet the requirements of Article 33(2) and (3) PCT, as none of the cited documents discloses or suggests an apparatus for transmitting information comprising a device emitting a signal and means sensing said signal, whereby one of the two components is mounted on a non-rotating sub and the other is coupled to the drill string.

Should however claim 12 be interpreted as specifying that both sensing means and signal emitting device are mounted on the drill string, then the claim would lack novelty in the light of D1 (see col. 3, l. 47-57).

V-6 What has been said about claims 8 and 9 apply also to claims 13, 15 and 14, respectively. And as said claims concern the same inventive concept as claim 12, claims 13-15 involve an inventive step Article 33(3) PCT.

V-7 As independent method claim 16 relates effectively to the same subject-matter as independent apparatus claim 1, said method claim does not meet the requirements of Article 33(2) and (3) PCT.

V-8 What has been said about claims 2, 4, 3 and 6, respectively, apply also to claims 17-20. The said claims do therefore not meet the novelty requirement of Article 33(2) PCT.

V-9 Claims 21 and 22 do not involve an inventive step (Article 33(3) PCT). See section VIII-2.

**Re Item VII**

**Certain defects in the international application**

VII-1 The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

VII-2 Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in D1 is not mentioned in the description, nor is this document identified therein.

VII-3 The Independent claims are not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known in combination from D1 being placed in the preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in the characterising part (Rule 6.3(b)(ii) PCT).

VII-4 The vague and imprecise statement in the description on page 15, last line implies that the subject-matter for which protection is sought may be different to that defined by the claims, thereby resulting in lack of clarity (Article 6 PCT) when used to interpret them (see also the PCT Guidelines, III-4.3a).

VII-5 It appears the first line of claim 1 should read: "... use in drilling or production from ...".

VII-6 It appears the second line of claim 10 should read: "... configured to detect alternating variations ...".

VII-7 It appears that the second line of claim 19 should read: "... step of stopping"

VII-8 It appears that in the description on page 4, line 10 of the fourth paragraph it should read: "... such that each revolution of the drill string ...".

**Re Item VIII**

**Certain observations on the international application**

VIII-1 One essential feature of the apparatus of claim 12 is that the "sensor means" mentioned in the first line of page 18 senses the signal generated by the "device" mentioned in the second line from the bottom of page 17 (see the description page 4, first two lines of the fourth paragraph). As the feature is not specified in claim 12, the claim therefore does not meet the requirement following from Article 6 PCT taken in combination with Rule 6.3(b) PCT that any independent claim must contain all the technical features essential to the definition of the invention.

Furthermore, the present wording of claim 12 can be read as specifying that the "non-rotating sub assembly" is an optional feature. At the contrary, it is essential (see the description page 4, last three lines of the fourth paragraph: "depending on the location of the emitter") that either the device generating the signal or the sensor means is located in a non-rotating assembly. This objection could be overcome by adding a sentence such as "said assembly comprising a non-rotating sub assembly" between the words "assembly" and "whereby" on the second line of the claim.

VIII-2 To satisfy the conciseness requirement or Article 6 PCT, the present set of claims should include only the minimum necessary number of independent claims in any one category. Said requirement is not satisfied by independent

claims 1 and 12, as in the present case, it is considered appropriate to use only one independent claim in any Reference is made to the following document:

D1: US-A-4 763 258

**Re Item III**

**Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

III-1 Claims 21 and 22 do not specify explicitly and univocally any technical feature, and therefore they cannot be further examined. Furthermore, said claims contain references to the drawings. According to Rule 6.2(a) PCT, claims should not contain such references except where absolutely necessary, which is not the case here.

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The subject-matter of said claims is therefore not new (Article 33(2) PCT).

V-3 Claims 8 and 9 relate to the problem of establishing a non-contact rotational reference as described in D1, col. 3, l. 52-57, where the magnetic field of the earth is used. To substitute the magnetic field of the earth with the self-emitting devices of claim 8 and 9 is involving not only selecting the sources but also substantial design changes in that the sources can not rotate with the drill string. None of this is made obvious by the cited prior art such that claims 8 and 9 involve an inventive step (Article 33(3) PCT).

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VII-1 The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

VII-2 Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in D1 is not mentioned in the description, nor is this document identified therein.

VII-3 The Independent claims are not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known in combination from D1 being placed in the preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in the characterising part (Rule 6.3(b)(ii) PCT).

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Furthermore, the present wording of claim 12 can be read as specifying that the "non-rotating sub assembly" is an optional feature. At the contrary, it is essential (see the description page 4, last three lines of the fourth paragraph: "depending on the location of the emitter") that either the device generating the signal or the sensor means is located in a non-rotating assembly. This objection could be overcome by adding a sentence such as "said assembly comprising a non-rotating sub assembly" between the words "assembly" and "whereby" on the second line of the claim.

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# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

| Applicant's or agent's file reference | FOR FURTHER ACTION | See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) |
|---|---|---|
| WPP81316 | | |
| International application No. | International filing date *(day/month/year)* | Priority date *(day/month/year)* |
| PCT/GB00/01629 | 27/04/2000 | 27/04/1999 |
| International Patent Classification (IPC) or national classification and IPC<br>E21B47/12 | | |
| Applicant<br>MCLOUGHLIN, Stephen John | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 9 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☒ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

| Date of submission of the demand | Date of completion of this report |
|---|---|
| 24/11/2000 | 11.07.2001 |
| Name and mailing address of the international preliminary examining authority:<br>European Patent Office<br>D-80298 Munich<br>Tel. +49 89 2399 - 0 Tx: 523656 epmu d<br>Fax: +49 89 2399 - 4465 | Authorized officer<br>Str mmen, H<br>Telephone No. +49 89 2399 7345 |

Form PCT/IPEA/409 (cover sheet) (January 1994)

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/01629

## I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
**Description, pages:**

1-15 as originally filed

**Claims, No.:**

1-22 as originally filed

**Drawings, sheets:**

1/4-4/4 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

   *(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

   ☐ the entire international application.

   ☒ claims Nos. 21-22.

because:

   ☒ the said international application, or the said claims Nos. 21-22 relate to the following subject matter which does not require an international preliminary examination (*specify*):
   **see separate sheet**

   ☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

   ☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

   ☐ no international search report has been established for the said claims Nos. .

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

   ☐ the written form has not been furnished or does not comply with the standard.

   ☐ the computer readable form has not been furnished or does not comply with the standard.

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

   Novelty (N) Yes: Claims 8-9, 11-15

| | | |
|---|---|---|
| | No: | Claims 1-7, 10, 16-20 |
| Inventive step (IS) | Yes: | Claims 8-9, 12-15 |
| | No: | Claims 1-7, 10-11, 16-20 |
| Industrial applicability (IA) | Yes: | Claims 1-20 |
| | No: | Claims |

2. Citations and explanations
**see separate sheet**

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:
**see separate sheet**

**VIII. Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
**see separate sheet**

Reference is made to the following document:

D1: US-A-4 763 258

**Re Item III**

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PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : E21B 47/12

A1

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| 9926545.6 | 9 November 1999 (09.11.99) | GB |

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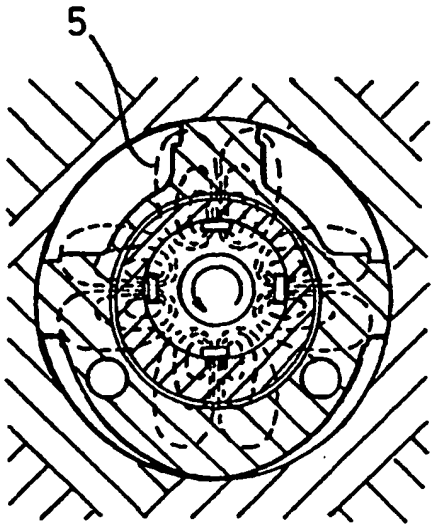
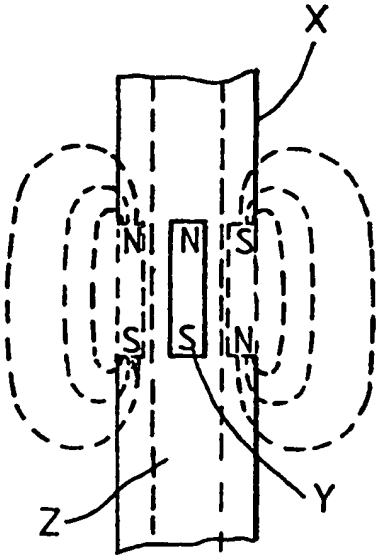
Published

*With international search report.*

(54) Title: APPARATUS AND METHOD FOR TRANSMITTING INFORMATION TO AND COMMUNICATING WITH A DOWN-HOLE DEVICE




(57) Abstract

An apparatus for use in drilling or producing from a well bore, the apparatus comprising a downhole member such as a drilling device or a production device which is capable of being attached to a tubular such as a drill string, production string or the like, means for rotating a tubular, control means for controlling the rotation of said tubular in order to transmit information along said tubular and means for monitoring the rotation of said tubular and for decoding said information transmitted along said tubular such that a magnitude of a parameter can be determined by the drilling member from the rotation of said tubular. The invention also relates to a method for communicating with a downhole tool using the apparatus.

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| **BB** | Barbados | **GH** | Ghana | **MG** | Madagascar | **TJ** | Tajikistan |
| **BE** | Belgium | **GN** | Guinea | **MK** | The former Yugoslav Republic of Macedonia | **TM** | Turkmenistan |
| **BF** | Burkina Faso | **GR** | Greece | | | **TR** | Turkey |
| **BG** | Bulgaria | **HU** | Hungary | **ML** | Mali | **TT** | Trinidad and Tobago |
| **BJ** | Benin | **IE** | Ireland | **MN** | Mongolia | **UA** | Ukraine |
| **BR** | Brazil | **IL** | Israel | **MR** | Mauritania | **UG** | Uganda |
| **BY** | Belarus | **IS** | Iceland | **MW** | Malawi | **US** | United States of America |
| **CA** | Canada | **IT** | Italy | **MX** | Mexico | **UZ** | Uzbekistan |
| **CF** | Central African Republic | **JP** | Japan | **NE** | Niger | **VN** | Viet Nam |
| **CG** | Congo | **KE** | Kenya | **NL** | Netherlands | **YU** | Yugoslavia |
| **CH** | Switzerland | **KG** | Kyrgyzstan | **NO** | Norway | **ZW** | Zimbabwe |
| **CI** | Côte d'Ivoire | **KP** | Democratic People's Republic of Korea | **NZ** | New Zealand | | |
| **CM** | Cameroon | | | **PL** | Poland | | |
| **CN** | China | **KR** | Republic of Korea | **PT** | Portugal | | |
| **CU** | Cuba | **KZ** | Kazakstan | **RO** | Romania | | |
| **CZ** | Czech Republic | **LC** | Saint Lucia | **RU** | Russian Federation | | |
| **DE** | Germany | **LI** | Liechtenstein | **SD** | Sudan | | |
| **DK** | Denmark | **LK** | Sri Lanka | **SE** | Sweden | | |
| **EE** | Estonia | **LR** | Liberia | **SG** | Singapore | | |

# Apparatus and Method for Transmitting Information to and Communicating with a Downhole Device

The present invention is concerned with the field of downhole tools. More specifically, the present invention is concerned with an apparatus and method for transmitting information to a downhole tool.

A drilling tool or member is a device suitable for drilling a well bore or the like. As the drilling tool drills further into the ground, communicating with the tool becomes more and more difficult. Other downhole tools, variously referred to as "production tools", fulfilling different functions from drilling tools yet having similar data requirements to drilling tools are considered equally within the scope of this apparatus and method.

The recognised term in the art for the method of transmitting information from the drilling tool to the surface is 'telemetry'. Telemetry can be achieved by many means, for example, 'hardwire', where the signal is passed along a conducting medium via electrical means and to which the drilling tool is attached.

The above telemetry method requires the provision of a separate communication route for the electrical signal from the surface. This provides drawbacks in terms of both cost and potential reliability as the signal must reach the tool when the tool is many miles below the surface.

A telemetry medium for communicating with the tool should ideally be one of the parameters which is readily available in either drilling or production scenarios. A drilling parameter is a parameter which must be supplied to the drilling tool in the vast majority of drilling scenarios.

Drilling parameters such as the 'weight-on-bit', pump cycling and drill string rotation have been previously been considered. However, generally, these have been used just to toggle a switch between two states, and represent, at worst a binary switching device and, at best, a means of stepping through multiple options.

The drill string rotation is a drilling parameter which is common to almost all rotary drilling operations. This is typically measured in revolutions per minute (RPM). Variations in the rotation of the drill string can be used, be that in terms of the actual rotational velocity, the time when the drilling string is continuously rotating at a continuous speed or a measured time when the drill string is not rotating can be used to transmit a sophisticated command sequence, wherein the rotary command parameter has magnitude. This is as opposed to the conventional toggle signal transmitted down the drill string to the drilling tool. Thus, this new apparatus and method addresses all the problems posed by known prior art.

Although the term "drill string" has been used, it will be appreciated that the "drill string" could be any tubular which is connected to a downhole tool. For example, rotation of a production string could also be used if the downhole tool is a production tool. A tubular can be any pipe or any medium which generally connects the downhole tool (when in position in the well bore) with a surface control station, providing that rotation of the tubular at the surface causes rotation of at least a part of the tubular at the downhole tool.

Therefore, in a first aspect, the present invention provides an apparatus for use in drilling or producing from a well bore, the apparatus comprising a downhole member capable of being attached to a tubular, means for rotating a tubular, control means for controlling the rotation of said tubular in order to transmit information along said tubular and means for monitoring the rotation of said tubular and for decoding said information transmitted along said tubular such that a magnitude of a parameter can be determined from the rotation of said tubular.

As previously described, the tubular may be a drill string, production string or the like. The downhole member may be a drilling tool, production tool or the like.

In a second aspect, the present invention provides a method for transmitting information along a tubular to a downhole member located within a well bore, the method comprising the steps of:

rotatably driving said tubular, wherein the rotation of said tubular is controlled in accordance with information which is to be transmitted along said tubular;

monitoring the rotation of said tubular; and

analysing the monitored rotation of said tubular such that a magnitude of a parameter can be determined from the rotation of said tubular.

The variation in the tubular rotation may be provided by varying the rotational velocity or frequency of the tubular, measuring the time for continuous rotation of the tubular, measuring the time between successive rotations of the tubular (i.e. the time when the tubular is not rotating), or any of the above parameters in either separately or in combination etc.

This ability to vary the rotational speed or frequency of the tubular allows a magnitude to be communicated to the downhole member as opposed to just a binary signal. Therefore a signal, such as a magnitude of the change in a drilling angle can be communicated to the tool by using just the tubular rotation. Explicitly, the measured frequency of the tubular at the downhole member can communicate a numerical value to the drill string.

The rotation or frequency of the tubular may be monitored by the use of an emitter device which emits a signal or influences its environment such that the rotation of the drill string is used to activate a sensor means.

The emitter device which emits a signal or influences its environment may comprise a magnet. Alternatively, or in addition to the magnet, the device may also comprise a device which emits a sonic or a radioactive signal.

The emitter device may be located on the tubular or rotating part of the apparatus connected to the tubular or on a non-rotating part of the apparatus.

The emitter device may comprise a mechanical switch which is activated by the rotation of the tubular, such that each revolution is equal to an analogue or digital data point.

The rotation of the tubular may be monitored using a sensor. The sensor may sense a field or a change in a field or signal emitted by the emitter. For example, if the emitter is a magnet then the sensor may be a Hall effect device or a magnetometer. Alternatively, the sensor may by used to sense changes in an inherently present parameter due to the rotation of the tubular. For example, the sensor may comprise an accelerometer which receives direct alternating gravitational data inputs as a direct result of the rotation of the tubular. Such a sensor would preferably sense the centre of the Earth for use in controlling a Measurement-While-Drilling, Logging-While-Drilling or similar device. The sensor regardless of its type, may be activated by the rotating tubular such that each resolution of the drill string is equal to an analogue or binary data point. The sensor may be located on the tubular, a rotating part of the apparatus connected to the tubular or a non rotating part of the apparatus or a non-rotating part of the apparatus depending on the location of the emitter.

Preferably, the sensor means comprises a timing device such that sensor outputs derived from the rotation of the tubular may be measured over time.

A plurality of emitters and/or sensors may be provided. If a plurality of emitter devices and/ or sensor means are provided then each of the devices and/or sensor means may be actuated in an independent or sequential manner. The plurality of emitters may be

located radially or axially on the rotating drill string. If the emitters are a plurality of magnets then the magnets may be aligned with alternating polarities.

The output from the sensor means may be analogue or digital. The output from the sensor means will generally be provided to a drive means or a logic means in order to control the drilling member or other device in accordance with the information transmitted down the drill string.

The sensor is preferably isolated from wellbore fluids and may be contained in a pressure housing. More preferably, the pressure housing is magnetically transparent. The output from the sensor may be utilized for triggering an activation means in the instrumentation of the downhole member or an assembly which is housed in a separate physical housing. The activation means may be logical, electronic, mechanical or physical in form. The activation means may be capable of activating multiple devices in either an independent or sequential manner. The actuation means may be bi-phase, incremental or continuous in nature.

The above apparatus or method preferably uses phase shift modulation or other means of checking for errors or variances in the tubular rotation.

The apparatus and method according to the first and second aspects of the invention (respectively) may be used with any downhole device where it is necessary to transmit a control parameter to the device, for example, to control the drilling direction.

However, they are especially suited for use with a wellbore directional steering tool as described in WO-A-96/31679. The latter device is an apparatus for selectively controlling from the surface, the drilling direction of wellbore. It comprises a hollow rotatable mandrel, an inner sleeve, an outer housing, a plurality of stabilizer shoes and a drive means. The hollow rotatable mandrel has a concentric longitudinal bore. The inner sleeve is rotatably coupled about the mandrel and has an eccentric longitudinal bore of sufficient diameter to allow free relative motion between the mandrel and the

inner sleeve. The outer housing is rotatably coupled around the inner eccentric sleeve and has an eccentric longitudinal bore forming a weighted side. The outer housing also has sufficient diameter to allow free relative motion between the inner sleeve. Two stabilizer shoes are longitudinally attached to or formed integrally with the outer surface of the outer housing. Finally, the drive means is arranged for selectively rotating the inner eccentric sleeve with respect to the outer housing.

An embodiment of the directional tool is shown in Figures 3A and 3B. It is shown in a configuration whereby it is attached to an adapter sub. 104, which can be attached to the drill string (not shown). The adapter sub is attached to the inner rotatable mandrel 111 and may not be necessary if the drill string pipe threads match the device threads. The mandrel is free to rotate within the inner eccentric sleeve 112. The mandrel 111 is capable of sustained rotation within the inner sleeve 112. The inner eccentric sleeve 112 may be turned freely within an arc, by a drive means (not shown), inside the outer eccentric housing or mandrel 113. The bearing surfaces between the inner and outer mandrels are not critical as they are not in constant mutual rotation, but they must be capable of remaining clean and in relatively low torque with respect to each other in the drilling environment.

The inner rotating mandrel 111, is attached directly to a drill bit 107. However, the threads may differ between the two elements and an adapter sub may be required for matching purposes.

Figure B shows the relative eccentricity of the inner, 112 and outer, 113 eccentric sleeves (outer housing). The outer housing consists of a bore passing longitudinally through the outer sleeve which accepts the inner sleeve. The outer housing is eccentric on its outside, shown as the "pregnant portion", 120.

The pregnant portion or weighted side, 120 of the outer housing forms the heavy side of the outer housing and is manufactured as a part of the outer sleeve. The pregnant housing contains the drive means for controllably turning the inner eccentric sleeve

within the outer housing. Additionally, the pregnant housing may contain logic circuits, power supplies, hydraulic devices, and the like which are (or may be ) associated with the 'on demand' turning of the inner sleeve.

There are two stabilizer shoes, 121, on either side of the outer housing located at right angles to the pregnant housing and on the centre line drawn through the center of rotation on the inner sleeve. These two shoes serve to counter any reactionary rotation on the part of the outer housing caused by bearing friction between the rotating mandrel 111 and the inner eccentric sleeve 112. The stabilizer shoes are normally removable and are sized to meet the wellbore diameter. The same techniques used to size a standard stabilizer can be applied in choosing the size of the stabilizer shoes. Alternatively, the shoes 121 can be formed integrally with the outer housing 113. The pregnant or weighted portion of the outer housing 113, will tend to seek the low-side of the hole and the operation of the apparatus depends on the pregnant housing being at the low-side of the hole.

The manner of functioning of the apparatus and method of the present invention to control a drilling device such as a directional drilling device as shown in Figures A and B will be described in more detail hereinbelow.

The present invention will now be described with reference to the following non-limiting preferred embodiments in which:

Figure 1 shows a schematic of an embodiment of the present invention;
Figure 2A shows a single cycle of a typical accelerometer output;
Figure 2B shows a plot of an accelerometer output used to measure a rotating drill string with a variable rotation speed;
Figure 3A shows a plot of rotation speed against time;
Figure 3B shows a plot of rotation speed against time, where the drillstring is switched between rotating at a fixed speed and zero rotation;

Figure 4A shows a cross section of a drilling tool in accordance with an embodiment of the present invention;
Figure 4B shows a cross section of a drilling tool in accordance with another embodiment of the present invention.
Figures 5A and B show a prior art drilling tool.

Figure 1 shows a schematic of an embodiment of the present invention, the drilling tool 21 is connected to the surface station 23 via drill string 25. To effect rotational drilling, the drill string 25 is rotated.

Surface station 23 is provided with rotation control means 27 which controls the rotation of the drill string. The drilling tool 21 has monitoring means 29 which monitors the rotation of the drill string 25.

Figure 2A shows the output of an accelerometer as the drill string rotates. In a single rotation of the drill string, the accelerometer output changes from a zero point to $V_{max}$, returning to zero, and passing though zero to point $V_{min}$ and then back to zero. The output of the accelerometer is generally sinusoidal with the magnitude of the maxim and the minima being $V_{max}$ and $V_{min}$ respectively. The amplitude and form of the wave is dependent on the attributes of the particular sensor being used and also the time it takes to complete a single 360° revolution.

In Figure 2A, the accelerometer is attached to the drill string. The starting point for the single rotation is taken from where a test mass in the accelerometer is in a neutral position.

Figure 2B shows an accelerometer output similar to figure 2A. Except, here, a number of rotation cycles of the drill string are shown and also, the rotational speed of the drill string is varied over time. The rotational speed of the drill string is generally measured in rotations per minute or RPM.

The output of the accelerometer in figure 2B shows three full rotation cycles of the drill string. The dotted vertical lines on the figure indicate the start and end of each cycle. Here, each cycle starts when the accelerometer output is at maximum $V_{max}$. However, it will be appreciated that any point of the cycle could be chosen as the start point.

The first rotation cycle has a period of $t_1$. Once this cycle is completed, the speed of rotation of the drill string is reduced over the second cycle until a third cycle with a period of rotation $t_2$ is achieved. Period $t_2$ is longer than period $t_1$, therefore, the speed of rotation in the first cycle is greater than that of the third cycle. Thus, a change in the rotation speed of the drill string can be detected at the drilling member or drilling tool. Hence, the rotation frequency of the drill string can be used to instruct the drilling member, downhole device or tool.

Figure 3A shows a plot of the rotational velocity of the drill string over time as the rotation velocity of the drill string is changed. Rotation of the drill string is started and the rotational velocity (or equivalently the frequency of rotation) is increased to $R_1$. The frequency is held at $R_1$ over time period [1]. When instructing a tool, this initial rotation frequency $R_1$ may be used to transfer data or information along the drill string, it may also be used to send a signal to prepare the drilling member for data transfer. This signal may transmit information to alert the drilling member that if subsequent rotation speeds follow a predetermined pattern then the intention is to transfer data to the drilling member. Also, this data set can be used to set a particular parameter which is going to be transmitted along the drill string. It should be noted that the length of period [1] as well as the frequency of rotation is itself a variable parameter which can be used to send information. Using combinatorial data transmission wherein timing and frequency variables have pre-set limits reduces the possibility of operator errors and accidental actuations may be avoided.

After time period [1], the rotation of the drill string is either reduced to zero or is reduced below a threshold value for time period [2]. The threshold value is $R_0$. Time period [2] is primarily used to create a clear distinction between instructions.

The frequency of rotation of the drill string is then increased to $R_2$ for time period [3]. This variation in the rotation frequency represents an easily identifiable codification as it varies both in rotational frequency and duration from time period [1]. The duration of time period [3] is restricted once again by reducing the rotational frequency to below threshold value $R_0$ for a second time period [2].

After the second time period [2] the rotation frequency is increased to $R_3$ for time period [4]. Rotational frequency $R_3$ is lower than that of $R_1$ and $R_2$. Time period [4] can be used as a separate data set or it can be used as supplemental data set to that transmitted in time period [3]. It may also be used as a preamble to a following data set (in a similar manner to the data set of period [1]) or it may be used as a terminating data set which may return the parameters of the tool to an equilibrium position.

Figure 3A shows that the present invention may be used to transmit codification which is linear, progressive and discrete: each data set may be sequential and may be separated from a the last data set by a period of zero or low frequency data. Each data set is dependent on the speed or frequency of rotation of the drill string during a pre-determined time period for its numeric value.

There are thus two data variables in each data set i.e. frequency and duration, which may be controlled from the surface. To summarise, these two variables may be used in a number if different ways in order to talk to the tool. The tool may have a number of different parameters which require instructions from the surface. The parameter which is to be changed may be set by the measured velocity or frequency of rotation and the amount which the parameter is to be changed by may be set by the duration of the signal. Alternatively, the parameter may be chosen by a preparatory data sequence (e.g. period [1] and the magnitude of the parameter may be communicated by the magnitude of the following velocity or frequency signal.

Averaging, standard code correction techniques, or other statistical means may be employed to improve the quality of the data obtained from each individual data set. Any number of data sets may be sequentially added in order to increase the quantity of data transmitted to the downhole instrumentation or mechanism(s).

Figure 3B shows a plot of rotation against speed similar to Figure 3A. In Figure 2B, the string is switched between a constant rotating speed $V_{rot}$ and not rotating. In other words, there is only one variable which is duration as the rotational velocity which is related to the frequency is maintained constant. Figure 3B shows a simplification of the transmission method described with relation to figure 3A.

As in Figure 3A, four time periods are shown in Figure 3B, in period 1, the drill string rotates at $V_{rot}$, the logic means of the drilling member are configured to read rotation at $V_{rot}$ as being an equilibrium stage where all logic parameters within the drill string are kept at their equilibrium values.

In period 2, the rotation of the drill string is stopped, the logic means of the drilling member vary a set parameter. For example, if the drilling direction of the drilling member is governed by the angular movement of a component of the drilling member (for example, 112 in Figure 5B), then the logic means may command the angular movement of the component for the whole of period 2.

When the drill string rotation is restarted, at the start of period 3, the movement of the component is stopped.

The movement of the component starts again at the start of period 4. (i.e. when the drill string rotation stops). Period 4 is twice as long as period 2. Therefore the component moves through twice the angle in period 4 as period 2.

Hence the duration of the period of non-rotation is converted into the angle of rotation for component 112.

Figure 4A shows a cross section of a down hole tool which may be used in accordance with an embodiment of the present invention. The actual tool shown in figure 4A is a modified version of the inventor's own prior art which is described in relation to figures 5A and 5B.

The tool comprises a outer housing 1 with an eccentric bore. An inner sleeve 2 is located within said bore such that the outer housing 1 is rotatably coupled about said inner sleeve 2. The inner sleeve 2 also has an eccentric bore which is configured to accommodate a rotating drill string member 3 such that said inner sleeve 2 can rotate relative to both said outer housing 1 and aid drill string member 3.

A magnet 4 is attached to said rotating member 3. The magnet is located in a pocket on said rotating member 3, the magnet may also be attached by some other means, for example, by adhesives. This specific embodiment uses the magnet as an emitter. However, it will be appreciated by those skilled in the art that the magnet could be replaced by any type of emitting sensor.

The outer housing 1 contains instrument barrels 6. The instrument barrels 6 are provided with sensing means. During drilling of the well bore 7, the heavy portion of the outer housing seeks the low side of the well bore and the position of the outer housing remains relatively fixed with respect to the well bore. The drill string 3 and magnet 4 rotate relative to the outer housing. Lines of flux 5 radiate from the magnet 4 in such a manner as to overcome the Earth's ambient field. The field should also be set high enough to compensate for the reduction in field strength over distance. The flux lines 5 extend radially beyond the instrument barrel 6 such that sensors within the instrument barrel 6 can detect the intensity of the emitted magnetic field. It should also be noted that the magnetic field strength should also be calculated giving due consideration to the differences in magnetic field strength of the Earth at extreme Northerly and Southerly latitudes.

When the magnet 4 is rotated such that it is closest to the sensors in the instrument barrel 6, then a maximum in the magnetic field is detected. When the magnet 4 is furthest form the instrument barrel 6, then a minimum in the magnetic field is detected. The filed detected by the sensors may be sinusoidal if is possible to sense the radiated magnetic field at all times when the member 3 is rotating. However, as it is only necessary to measure the frequency of rotation of the member, it is adequate if the sensor is just configured to detect a maxima in the field when the magnet is at its closest to the sensor. In other words, the sensor just needs to detect a series of pulses where each pulse is equivalent to one each rotation of the member 3.

Thresholds may also be set which negate the effect of the Earth's magnetic field and which serve as limit switches. These limit switches may be employed as a means of logic control within the sensor array or within a logic control sub assembly.

A second instrument barrel 6a is also shown. This may also contain magnetic sensors. The provisions of two magnetic sensors allows the direction of the rotation of the drill string to be accurately determined as well as its magnitude.

The sensor which isolated within the instrument barrel is preferably situated in a stainless steel, or another magnetically transparent pressure vessel such that the instrumentation is isolated from the borehole pressure. The instrumentation barrel may comprises a magnetometer, or Hall effect device or the like for detecting the magnetic field.

Inevitably, there will be material between the magnetic sensor in the instrument barrel 6 and the magnet 4 located on the rotating member. This intervening material should, as far as possible, be magnetically transparent. In other words, the magnetic field should pass through this material without becoming deflected or distorted. Materials which exhibit these properties include austenic stainless steels and other non-ferrous material.

Figure 4B shows a variation on the device of figure 4A, In figure 4B the rotating drill string is provided with four magnets 4 arranged at 90° to one another. In the figure the magnets 4 are embedded within the outer rotating wall of the member 3. However, it should be noted that the magnets could be embedded in the inner rotating wall of the member 3.

More sophisticated coding is achievable with more than one emitter. Further, the inversion of one of the sensors can be used to provide error checking or other programming advantages to the present invention. Multiple magnets may also be used to increase the frequency of the signal from the rotating member 3 or for actuation of multiple sensors within a single data set time frame, for example, as a means of compressing data.

Multiple magnets may have the same polarity or they may have alternating alignment of polarity. In figure 4B, the magnets 4 are arranged across the same section of the tubular. However, it will be appreciated that the magnets could be arranged at various axial spacings along the member 3.

Although not shown in either of figures 4A or 4B, the downhole device will have analysis means to analyse the information sent along the drill string. If the information which is sent along the drill string requires mechanical movement of a component of the drilling tool or member, then drive means are required to move the required component are instructed. For example, the drive means may move a component either radially or axially in the drilling tool. In addition to mechanical information, the drilling tool may also require instructions which are essentially electronic in nature. For example, information relating to the preferred rate of data transmission may be sent along the drill string.

In both the generalised and preferred embodiments of the assembly, it should be understood the different signalling means may be employed, that different

configurations my be used and that other modifications may be made without departing from the spirit and scope of the present invention as defined by the appended claims.

**CLAIMS:**

1. An apparatus for the use of drilling or producing from a well bore, the apparatus comprising a downhole member capable of being attached to a tubular, means for rotating the tubular, control means for controlling the rotation of said tubular in order to transmit information along said tubular and means for monitoring the rotation of said tubular and for decoding said information transmitted along said tubular such that a magnitude of a parameter can be determined from the rotation of said tubular.

2. An apparatus according to claim 1, wherein the control means is configured to control the rotational velocity or frequency of the tubular.

3. An apparatus according to either of claims 1 or 2, wherein the control means is configured to stop the rotation of the tubular for a predetermined time.

4. An apparatus according to claim 3, wherein the monitoring means is configured to measure the time of non-rotation of the tubular.

5. An apparatus according to either of claims 3 or 4, wherein the monitoring means is configured to measure the time over which the tubular is continuously rotating.

6. An apparatus according to claim 5, wherein the monitoring means is configured to measure the time over which the tubular is continuously rotating at a particular rotational speed.

7. An apparatus according to any preceding claim, wherein the monitoring means is configured to count the number of rotations of the tubular.

8. An apparatus according to any preceding claim, wherein the monitoring means comprises a magnet.

9. An apparatus according to any preceding claim, wherein the monitoring means comprises at least one of a radioactive or sonic source.

10. An apparatus according to any preceding claim, wherein the monitoring means comprises a gravitational accelerometer configured to detected alternating variations in the gravitational field due to rotation of the tubular.

11. An apparatus according to any preceding claim, wherein said drilling member comprises:

a hollow rotatable mandrel having a concentric longitudinal bore;

an inner sleeve rotatably coupled about said mandrel, said inner sleeve having an eccentric longitudinal bore of sufficient diameter to allow free relative motion between said mandrel and said inner sleeve;

an outer housing having an outer surface, said outer housing is rotatably coupled around said inner eccentric sleeve, said outer housing having an eccentric longitudinal bore forming a weighted side adapted to automatically seek the low side of the wellbore and having sufficient diameter to allow free relative motion between said inner sleeve and

a plurality of stabilizer shoes longitudinally attached to or formed integrally with said outer surface of said outer housing;

drive means for selectively rotating said inner eccentric sleeve with respect to said outer housing and

logic means for controlling said drive means based on the information transmitted along said drill string.

12. An apparatus for transmitting information in a timely manner from the face of the Earth to a downhole assembly, whereby the rotation of the drill string is used as an output device, conveying information to components which are located in the wellbore, the apparatus comprising:

a device which is closely coupled to either the drill string , or a non-rotating sub assembly, which emits a signal or influences its environment such that the rotation of

the drillstring is used to activate a sensor means which may be integrated into either the drill string, or a non-rotating sub-assembly with a timing device such that the sensor outputs derived from the rotation of the drillstring system may be measured against a time-based system such that meaningful encoding may be accomplished, which may be coupled to an actuation or switching mechanism or mechanisms.

13. An apparatus according to claim 12, wherein the emitter or device influencing the environment comprises a magnet or a magnetic device.

14. An apparatus according to claim 12, wherein the emitter or device influencing the environment comprises a mechanical switch which is activated by the rotation of the drill string.

15. An apparatus according to claim 12, wherein the emitter or device influencing the environment comprises at least one of a sonic or radioactive source.

16. A method of transmitting information along a tubular to a downhole member located within a well bore, the method comprising the steps of:

rotatably driving said tubular, wherein the rotation of said tubular is controlled accordance with information which is to be transmitted along said tubular;

monitoring the rotation of said tubular; and

analysing the monitored rotation of said tubular such that a magnitude of a parameter can be determined from the rotation of said tubular.

17. A method according to claim 16, wherein the step of monitoring the rotation of said tubular comprises the step of monitoring the rotational velocity of the tubular.

18. A method according to either of claims 16 or 17, wherein the step of monitoring the rotation of the tubular comprises the step of timing a period of non-rotation of the tubular.

19. A method according to claim 16, wherein the step of driving the tubular comprises the step stopping the rotation of the tubular for a pre-determined time determined by the information which is to be transmitted along the tubular.

20. A method according to claim 16, wherein the step of monitoring the rotation of the tubular comprises the step of measuring the time over which the tubular is continuously rotating at a particular frequency.

21. An apparatus as substantially hereinbefore described with reference to any of figures 1 to 4B.

22. A method as substantially hereinbefore described with reference to any of figures 1 to 4B.

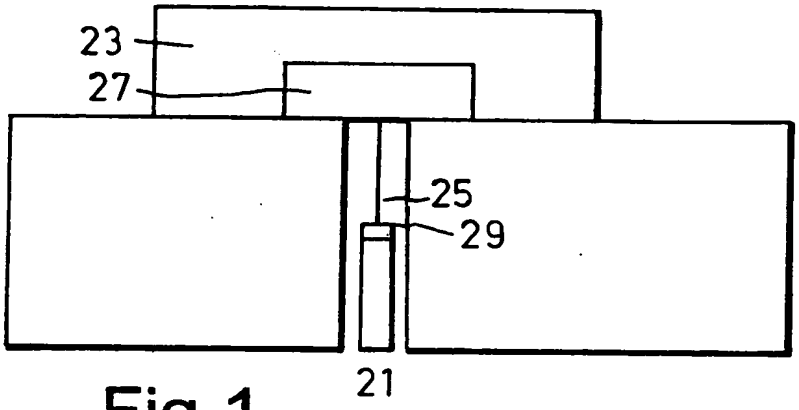


Fig.1

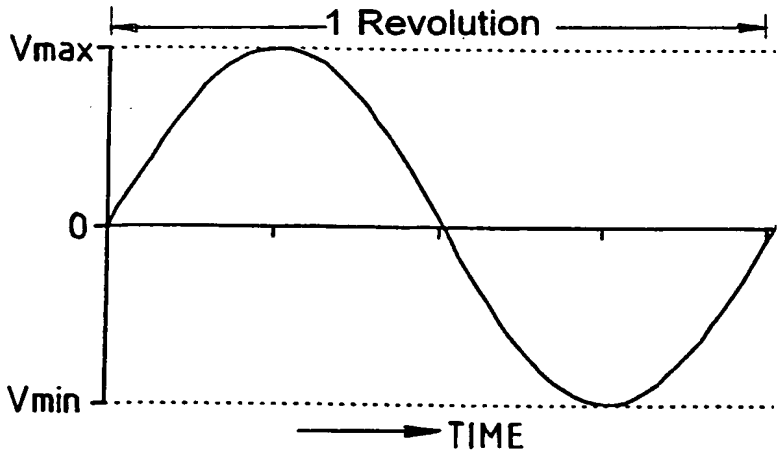


Fig.2A

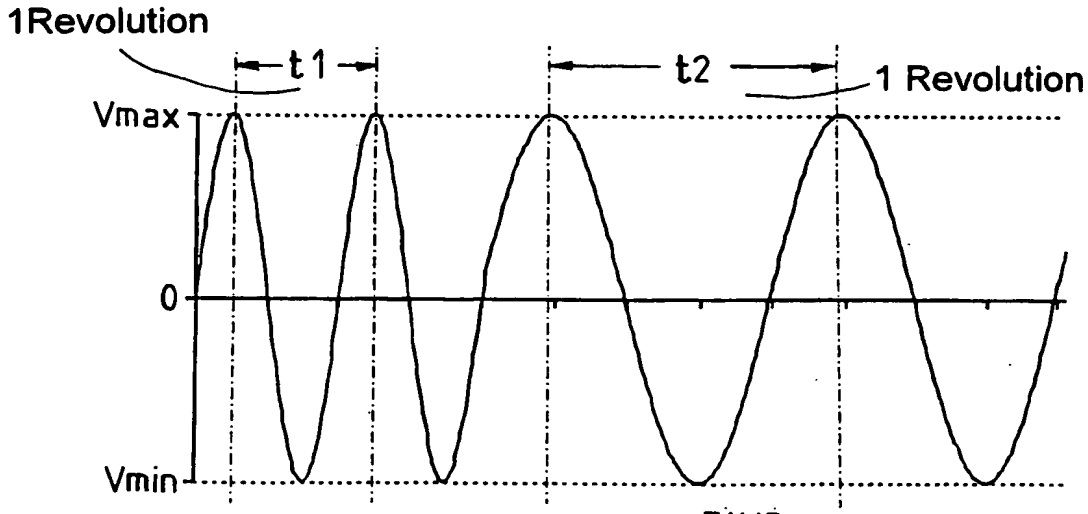


Fig.2B

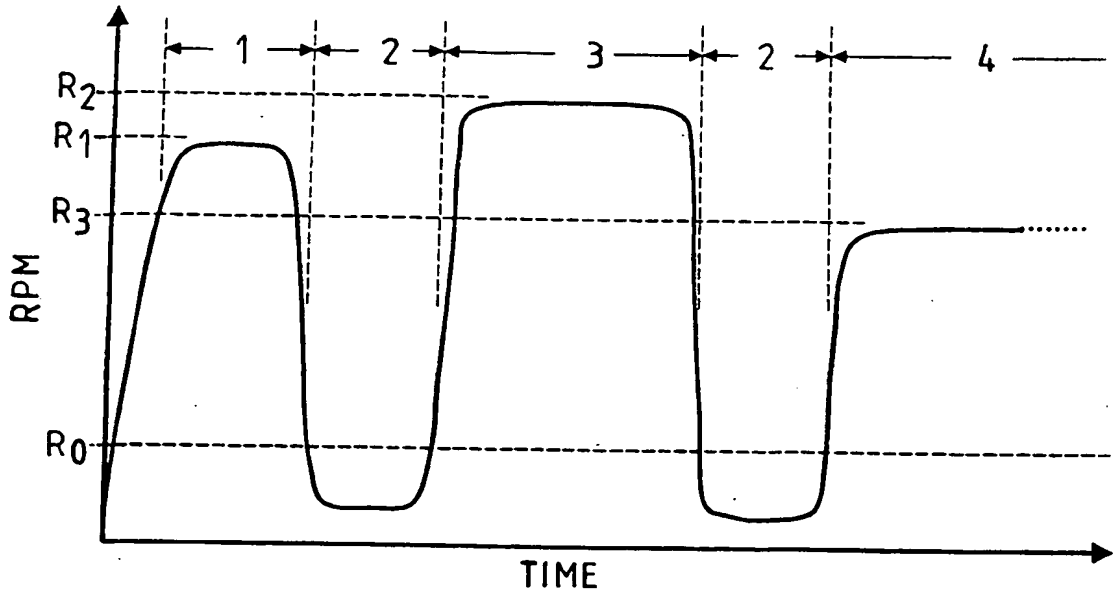


Fig.3A

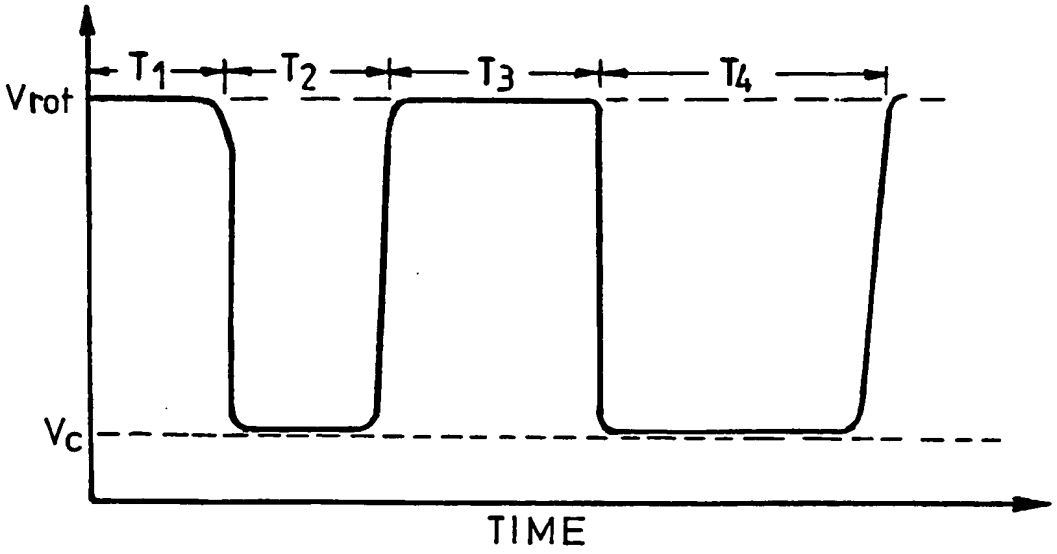


Fig.3B

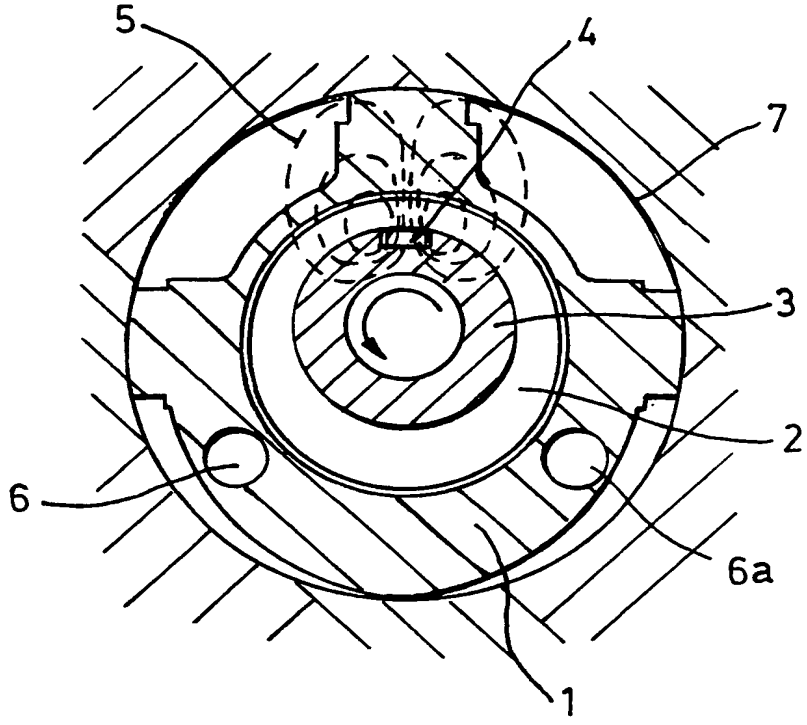


Fig.4A

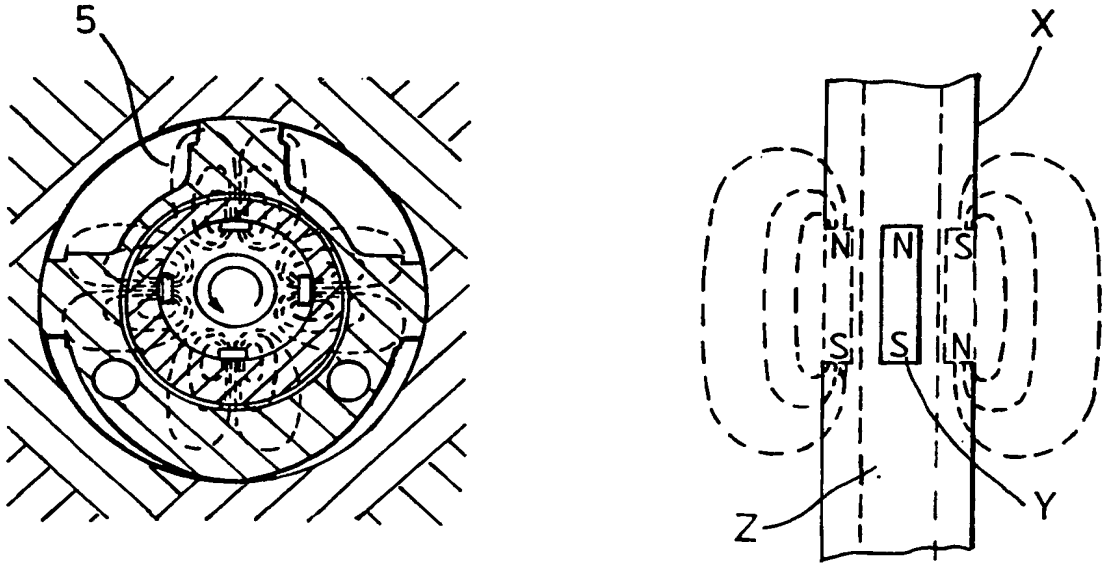


Fig.4B

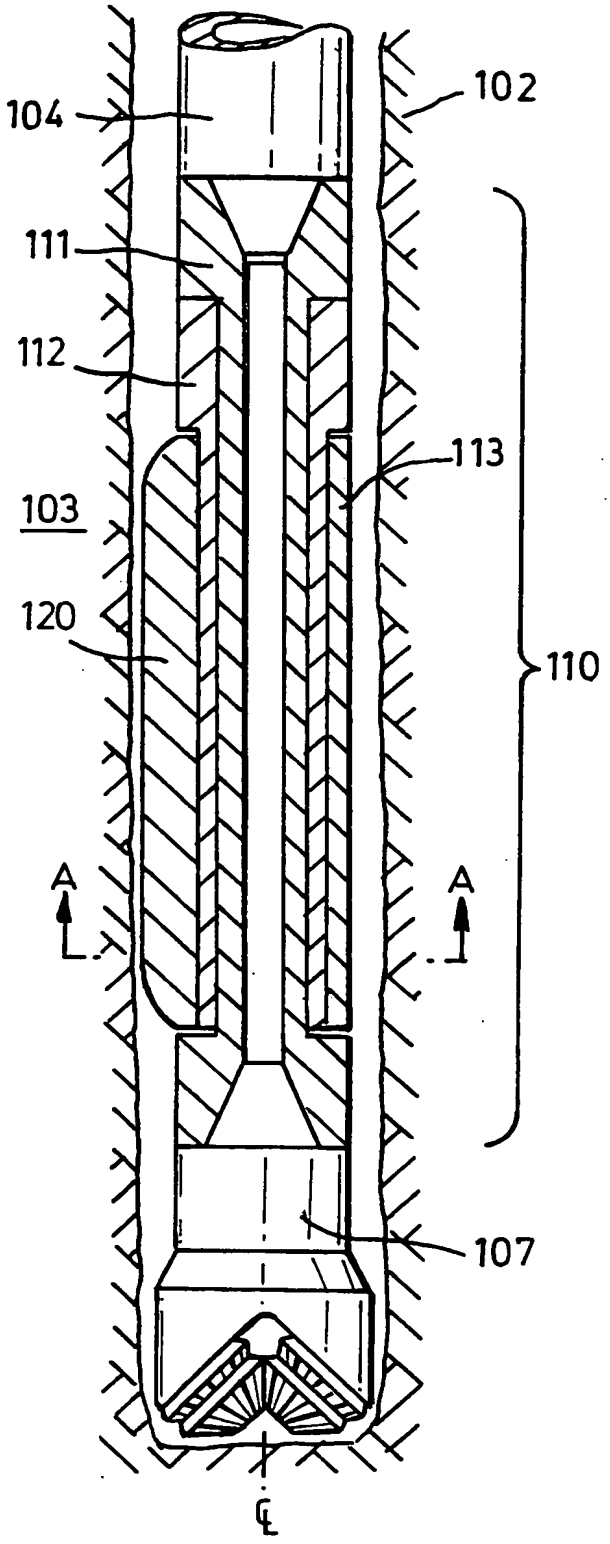
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Fig.5A

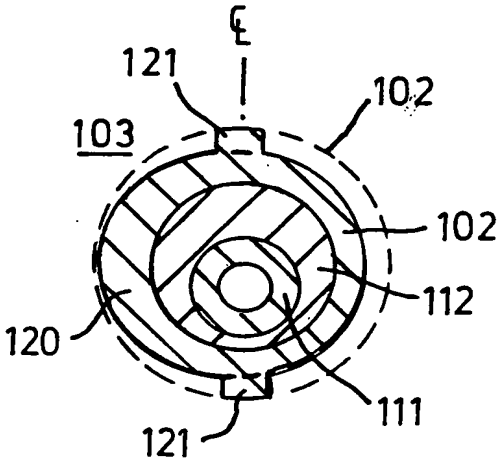
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Fig.5B

# INTERNATIONAL SEARCH REPORT

Inter. nal Application No
PCT/GB 00/01629

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 E21B47/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | US 4 763 258 A (ENGELDER PAUL D)<br>9 August 1988 (1988-08-09)<br>the whole document | 1-8,12,<br>13,16-20 |
| A | US 3 967 680 A (JETER JOHN DOISE)<br>6 July 1976 (1976-07-06)<br>claim 1 | 1 |
| A | US 5 456 316 A (OWENS STEVEN C ET AL)<br>10 October 1995 (1995-10-10)<br>abstract | 1 |
| A | GB 2 100 321 A (AMF INC)<br>22 December 1982 (1982-12-22)<br>abstract | 1 |

☐ Further documents are listed in the continuation of box C.

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"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 27 July 2000 | 03/08/2000 |

| Name and mailing address of the ISA | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL – 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,<br>Fax: (+31-70) 340-3016 | Schouten, A |

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

Interr nal Application No
PCT/GB 00/01629

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| US 4763258 A | 09-08-1988 | NONE | |
| US 3967680 A | 06-07-1976 | NONE | |
| US 5456316 A | 10-10-1995 | CA 2147300 A | 26-10-1995 |
| | | DE 19514764 A | 26-10-1995 |
| | | GB 2288834 A,B | 01-11-1995 |
| | | NO 951550 A | 26-10-1995 |
| GB 2100321 A | 22-12-1982 | NL 8202369 A | 03-01-1983 |

PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

| Applicant's or agent's file reference | FOR FURTHER ACTION | see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below. |
|---|---|---|
| WPP81316 | | |
| International application No. | International filing date *(day/month/year)* | (Earliest) Priority Date *(day/month/year)* |
| PCT/GB 00/ 01629 | 27/04/2000 | 27/04/1999 |

Applicant

MCLOUGHLIN, Stephen John

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**

   [ ] the text is approved as submitted by the applicant.

   [X] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. 4b

   [ ] as suggested by the applicant.

   [ ] because the applicant failed to suggest a figure.

   [X] because this figure better characterizes the invention.

   [ ] None of the figures.

**Box III TEXT OF THE ABSTRACT (Continuation of item 5 of the first sheet)**

Line 2, delete "(21)"
Line 4, delete "(25)"
Line 5, delete "(4)"
Line 7, delete "(25)"
Line 8, delete "(21)"

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International Application No
PCT/GB 00/01629

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|---|---|
| 27 July 2000 | 03/08/2000 |

| Name and mailing address of the ISA | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL – 2280 HV Rijswijk<br>Tel. (+31–70) 340–2040, Tx. 31 651 epo nl,<br>Fax: (+31–70) 340–3016 | Schouten, A |

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/GB 00/01629

| Patent document cited in search report | | Publication date | Patent family member(s) | | Publication date |
|---|---|---|---|---|---|
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| US 3967680 | A | 06-07-1976 | NONE | | |
| US 5456316 | A | 10-10-1995 | CA | 2147300 A | 26-10-1995 |
| | | | DE | 19514764 A | 26-10-1995 |
| | | | GB | 2288834 A,B | 01-11-1995 |
| | | | NO | 951550 A | 26-10-1995 |
| GB 2100321 | A | 22-12-1982 | NL | 8202369 A | 03-01-1983 |

**CLAIMS:**

1. An apparatus for the use of drilling or producing from a well bore, the apparatus comprising a downhole member capable of being attached to a tubular, means for rotating the tubular, control means for controlling the rotation of said tubular in order to transmit information along said tubular and means for monitoring the rotation of said tubular and for decoding said information transmitted along said tubular such that a magnitude of a parameter can be determined from the rotation of said tubular.

2. An apparatus according to claim 1, wherein the control means is configured to control the rotational velocity or frequency of the tubular.

3. An apparatus according to either of claims 1 or 2, wherein the control means is configured to stop the rotation of the tubular for a predetermined time.

4. An apparatus according to claim 3, wherein the monitoring means is configured to measure the time of non-rotation of the tubular.

5. An apparatus according to either of claims 3 or 4, wherein the monitoring means is configured to measure the time over which the tubular is continuously rotating.

6. An apparatus according to claim 5, wherein the monitoring means is configured to measure the time over which the tubular is continuously rotating at a particular rotational speed.

7. An apparatus according to any preceding claim, wherein the monitoring means is configured to count the number of rotations of the tubular.

8. An apparatus according to any preceding claim, wherein the monitoring means comprises a magnet.

TO BE SUBSTITUTED

9. An apparatus according to any preceding claim, wherein the monitoring means comprises at least one of a radioactive or sonic source.

10. An apparatus according to any preceding claim, wherein the monitoring means comprises a gravitational accelerometer configured to detected alternating variations in the gravitational field due to rotation of the tubular.

11. An apparatus according to any preceding claim, wherein said drilling member comprises:

a hollow rotatable mandrel having a concentric longitudinal bore;

an inner sleeve rotatably coupled about said mandrel, said inner sleeve having an eccentric longitudinal bore of sufficient diameter to allow free relative motion between said mandrel and said inner sleeve;

an outer housing having an outer surface, said outer housing is rotatably coupled around said inner eccentric sleeve, said outer housing having an eccentric longitudinal bore forming a weighted side adapted to automatically seek the low side of the wellbore and having sufficient diameter to allow free relative motion between said inner sleeve and

a plurality of stabilizer shoes longitudinally attached to or formed integrally with said outer surface of said outer housing;

drive means for selectively rotating said inner eccentric sleeve with respect to said outer housing and

logic means for controlling said drive means based on the information transmitted along said drill string.

12. An apparatus for transmitting information in a timely manner from the face of the Earth to a downhole assembly, whereby the rotation of the drill string is used as an output device, conveying information to components which are located in the wellbore, the apparatus comprising:

a device which is closely coupled to either the drill string , or a non-rotating sub assembly, which emits a signal or influences its environment such that the rotation of

10 BE SUBSTITUTED

the drillstring is used to activate a sensor means which may be integrated into either the drill string, or a non-rotating sub-assembly with a timing device such that the sensor outputs derived from the rotation of the drillstring system may be measured against a time-based system such that meaningful encoding may be accomplished, which may be coupled to an actuation or switching mechanism or mechanisms.

13. An apparatus according to claim 12, wherein the emitter or device influencing the environment comprises a magnet or a magnetic device.

14. An apparatus according to claim 12, wherein the emitter or device influencing the environment comprises a mechanical switch which is activated by the rotation of the drill string.

15. An apparatus according to claim 12, wherein the emitter or device influencing the environment comprises at least one of a sonic or radioactive source.

16. A method of transmitting information along a tubular to a downhole member located within a well bore, the method comprising the steps of:

rotatably driving said tubular, wherein the rotation of said tubular is controlled accordance with information which is to be transmitted along said tubular;

monitoring the rotation of said tubular; and

analysing the monitored rotation of said tubular such that a magnitude of a parameter can be determined from the rotation of said tubular.

17. A method according to claim 16, wherein the step of monitoring the rotation of said tubular comprises the step of monitoring the rotational velocity of the tubular.

18. A method according to either of claims 16 or 17, wherein the step of monitoring the rotation of the tubular comprises the step of timing a period of non-rotation of the tubular.

To be substituted

19. A method according to claim 16, wherein the step of driving the tubular comprises the step stopping the rotation of the tubular for a pre-determined time determined by the information which is to be transmitted along the tubular.

20. A method according to claim 16, wherein the step of monitoring the rotation of the tubular comprises the step of measuring the time over which the tubular is continuously rotating at a particular frequency.

21. An apparatus as substantially hereinbefore described with reference to any of figures 1 to 4B.

22. A method as substantially hereinbefore described with reference to any of figures 1 to 4B.

TO BE SUBSTITUTED